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## Do we need MRI quality assurance : experience from a multi-unit imaging center with 14 MRI systems

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## **Do we need MRI quality assurance: experience from a multi-unit imaging center with 14 MRI systems**

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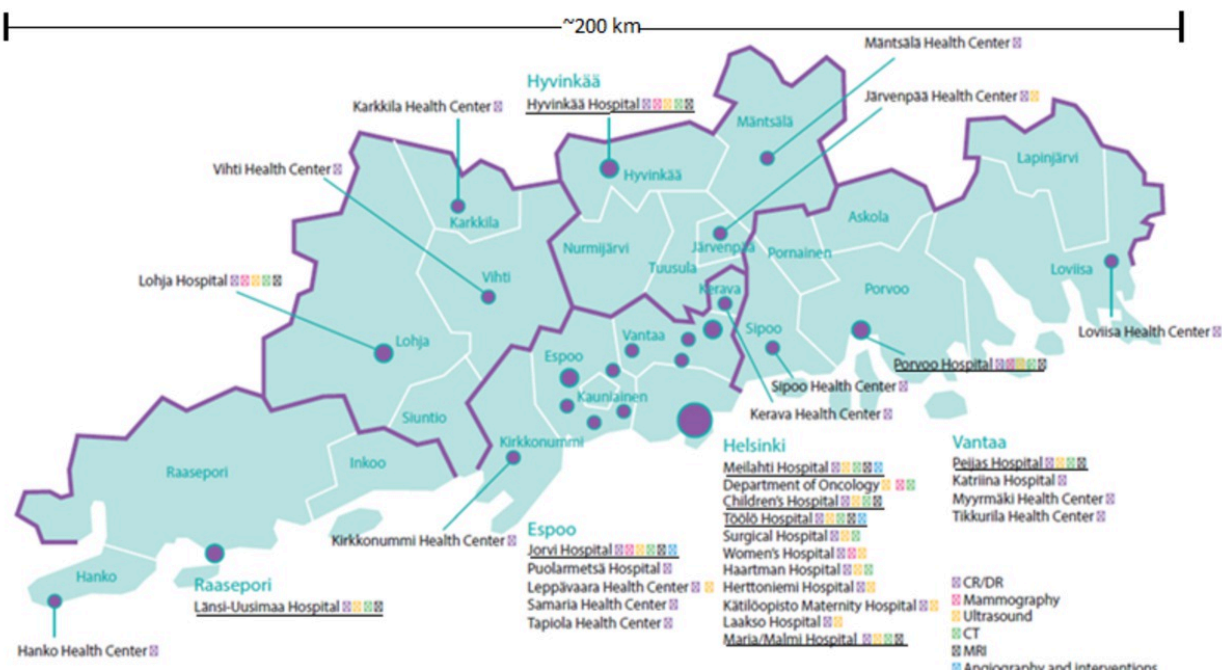
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# Purpose

## MRI at HUS Medical Imaging Center

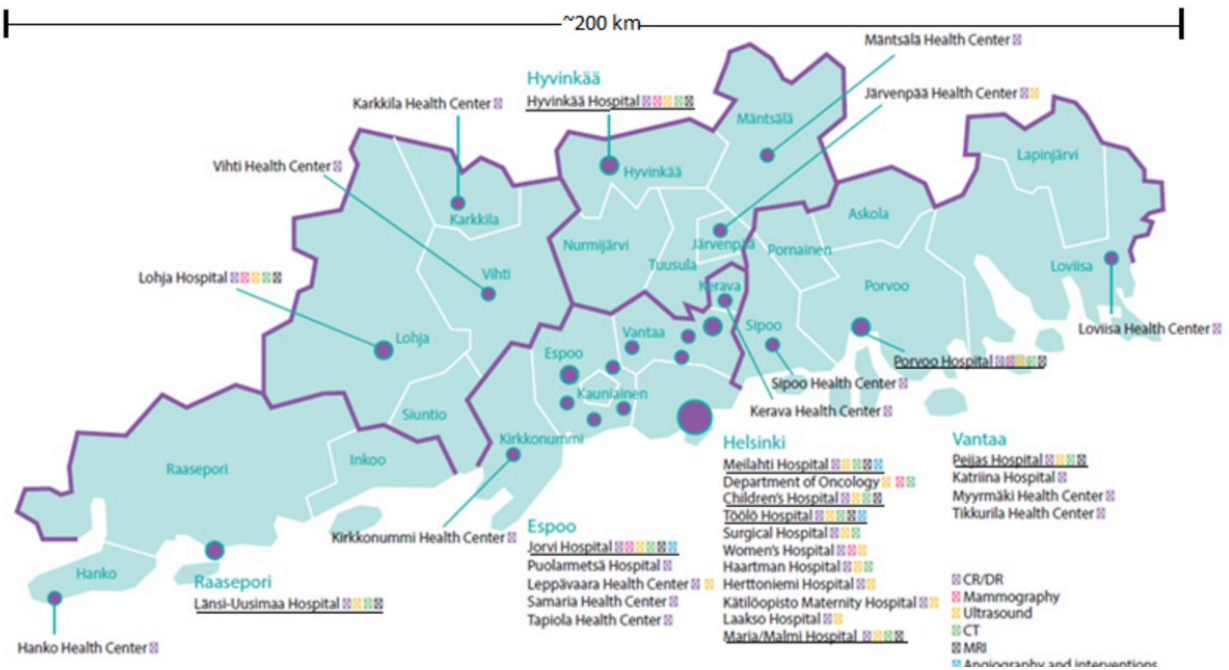
- Multi-unit center with 14 MRIs (i.e. three 3T, seven 1.5T, three mobile 1.5T and one dedicated extremity scanner)
- Approx. 63 000 clinical studies/year
- The quality assurance procedures need to be time and resource efficient in a unit with several scanners.
- The purpose of this work is to describe and evaluate our QA protocols.



**Fig. 1:** The MRI units are spread across the southern Finland. The hospital with MRIs are underlined.

**References:** Radiology, HUS Helsinki Medical Imaging Center - Helsinki/FI

**Images for this section:**



**Fig. 1:** The MRI units are spread across the southern Finland. The hospital with MRIs are underlined.

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# Methods and materials

QA consisted of three parts and it was performed on all scanners:

## 1. Daily test

- A single slice spin-echo image of a homogeneous phantom acquired before clinical studies and sent to a server.
- Automatic analysis of the SNR, ghosting and image intensity uniformity.

## 2. Annual American College of Radiology (ACR) phantom test

- Performed according ACR site scanning instructions, which include acquisition of ACR specific T1 and T2 sequences and also site specific T1 and T2.
- Data was semiautomatically analyzed in line with ACR instructions, which included the assessment of geometric accuracy, spatial resolution, slice thickness, slice position, intensity uniformity and ghosting.

## 3. Annual manufacturer specific coil tests of approx. 170 coils.

**Images for this section:**



**Fig. 2:** One of the scanners at HUS Medical Imaging Center

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# Results

## 1. Daily tests

- In daily test, exceptions were observed in 3 scanners.
- One exception was caused by a faulty gradient amplifier

## 2. ACR phantom test

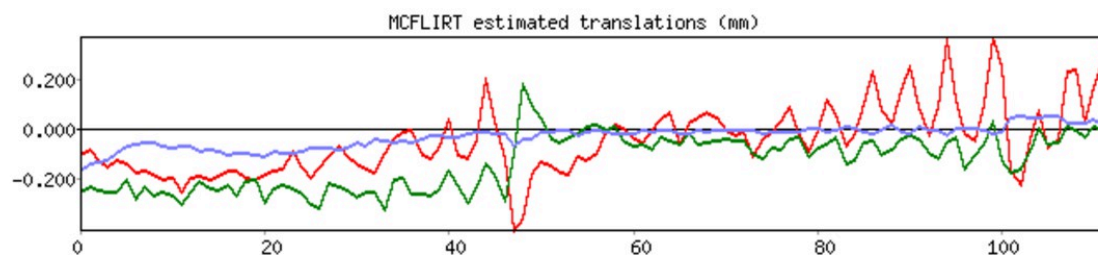
- In ACR specific T1 and T2 sequence the obtained results did not meet the ACR requirements for three scanners for geometric accuracy.
- For the site specific T1 sequence the the results for ten scanners were not according to specifications, with inferior results in resolution, geometric accuracy, and slice thickness
- For the site specific T2 sequence seven scanner did not meet the requirements mainly for slice thickness and geometric accuracy.

## 3. Coil tests

- Five faulty coils were observed with the annual coil tests, that had not been observed otherwise.
- However, we do not have statistics of coils changed for other reasons e.g. image artifact observed in routine imaging.

## Conclusion

- MRI personnel think that the daily test are beneficial, because it enables the personnel to test that the scanner is working properly in the morning.
- The automatic analysis of the daily test reduces the time and effort put in to the analysis.
- The automatic analysis of ACR phantom test assures that the image quality is always assessed in the same way.
- Coil tests are quite time and resource consuming, because there are several coils to test per scanner.
- The number of faulty coils in the coil test was quite low (5), because the faults are probably immediately observed as image quality problems.
- We think that QA is necessary and our procedure appears to be sufficient to detect faults and inferior image quality for routine clinical imaging.
- We are also able to manage the quality of a large number of scanners in a resource-efficient way.
- For advanced imaging e.g. fMRI, the current QA-procedures may not be sufficient, because in an EEG-fMRI study the faulty gradient amplifier caused problems before it was observed with the daily tests or ACR test.

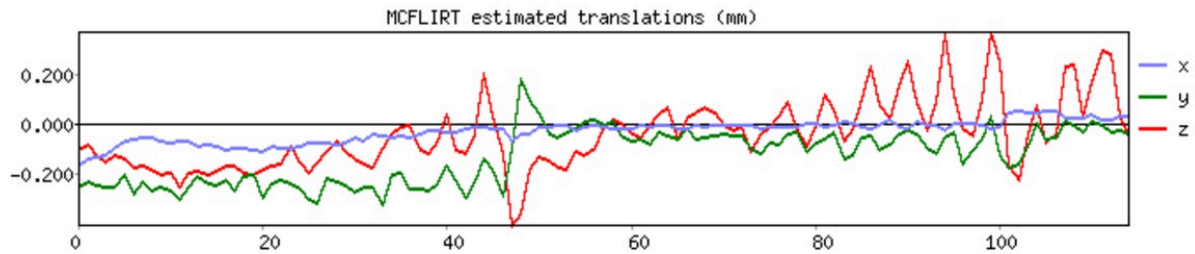


**Fig. 3:** Output of a motion correction translation parameters from an EEG-fMRI study. After 15 minutes of fMRI acquisition, there was observed severe fluctuation and it persisted for the rest of the imaging session.

**References:** Radiology, HUS Helsinki Medical Imaging Center - Helsinki/FI



### Images for this section:



**Fig. 3:** Output of a motion correction translation parameters from an EEG-fMRI study. After 15 minutes of fMRI acquisition, there was observed severe fluctuation and it persisted for the rest of the imaging session.

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